

# Minuteman Air Force Option for National Missile Defense

1997

DECLASSIFICATION STATEMENT A

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## Executive Summary

**How and when to defend the United States against ballistic missile attack is once again part of the national debate**

There is renewed interest in developing and possibly deploying a near-term, single-site, ground-based National Missile Defense (NMD) system to protect all 50 states.

If the Nation requires, the Air Force (AF) proposes retrofitting the proven and reliable Minuteman (MM) missile with a defensive non-nuclear kill vehicle designed to counter the rogue nation threat.

## Proposed Minuteman NMD Architecture

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The MM-based interceptor architecture entails the use of the MM booster; its infrastructure; existing strategic sensors; and the current command, control and communications (C<sup>3</sup>) network.

The MM NMD proposal calls for 20 MM interceptors deployed at existing MM facilities, X-band radars, upgraded early warning radars, and existing BMC<sup>3</sup> infrastructure.

### **Advantages of the Minuteman Proposal**

By maximizing the use of the existing MM missile force, sensors, C<sup>3</sup> systems and infrastructure, the MM NMD option lowers program risk and reduces cost.

Conserves scarce resources which can be applied to develop longer-term NMD.

Lowest cost option that can protect all 50 states from a single site. (in a detailed 60-page report, the AF System Program Office costed MM NMD at \$2.4B.)

Fits well within BMDO's "3 plus 3" effort by offering the earliest possible NMD deployment option -- if the Nation requires, can be operational within four years.

### **Arms Control Issues**

The AF believes it has developed a Treaty-compliant path for a MM interceptor.

### **Summary**

If required by the Nation, a Minuteman-based NMD would be operationally effective, affordable and capable of protecting all 50 states against a rogue nation threat.

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### **Introduction**

The question of when and how to defend the United States against ballistic missile attack is once again a topic of national debate. Some are concerned about the possibility of the rapid emergence of a rogue nation ballistic missile threat to the United States. As a result, there is renewed interest in the development and possible deployment of a near-term, single-site, ground-based National Missile Defense (NMD) system to protect North America, (including Alaska) and Hawaii. Should this result in a national decision to pursue a near-term capability against a limited, rogue nation threat, an approach should be taken which is competing needs will dictate an approach which must be both effective and affordable. The purpose of this paper is to describe an option for a system which maximizes the use of existing components and infrastructure to provide the desired capability at the earliest time, at the least cost and technological risk, with appropriate growth potential, and within existing arms control agreements.

Specifically, this system would use selected components of the existing inuteman missile force, upgraded early warning sensors, and current command and control infrastructure to achieve a low-cost, near-term and operationally effective ballistic missile defense capability. This

approach is fully consistent with U.S. strategic defense policy and acquisition strategy, conserves scarce resources, capitalizes on fully developed, proven and already available national assets, reduces risk, and provides a needed bridge in the technical evolution toward a more robust defensive system.

## **Background**

The Ballistic Missile Defense Program has undergone marked change since 1983 when President Reagan called for a U.S. strategic defense capability to render nuclear weapons "impotent and obsolete." The resulting effort to find meaningful defenses against a massive Soviet intercontinental ballistic missile (ICBM) attack on the United States became known as the Strategic Defense Initiative, managed by the Strategic Defense Initiative Organization (SDIO), now called the Ballistic Missile Defense Organization (BMDO).

The collapse of the Soviet Union and the end of the Cold War, coupled with attacks on American and allied troops by Iraqi Scuds during the Gulf War of 1991, led to a refocusing of the Ballistic Missile Defense (BMD) effort toward more limited threats -- accidental or unauthorized strategic launches and emerging third world regional threats. At that time, the emerging regional threats were considered to be limited to short- and medium-range ballistic missiles in the hands of rogue actors which could be most appropriately countered by the deployment of theater ballistic missile defenses (TMD) to defend U.S. forces and allies overseas.

Following the 1994 elections, some in the new Congress began to call for the rapid acceleration of national missile defense development, leading to deployment of a capable defense system as soon as possible. This shift toward early deployment reflected a general sense that the risk of the rapid emergence of a ballistic missile threat to the United States by determined rogue actors was becoming increasingly acute.

BMDO responded by creating a "Tiger Team" to develop an NMD architecture capable of being deployed at the earliest possible date to counter the developing rogue nation ballistic missile threat. The threat scenario addressed by the Tiger Team was the acquisition of SS-25-like technology by Libya. The Tiger Team considered a number of NMD alternatives, including options to deploy a system as early as possible, if required. The initial architecture the Tiger Team considered was 20 Minuteman ICBMs -- retrofitted with kinetic kill vehicles -- at Grand Forks AFB, ND, supported by a network of existing Early Warning Radars (EWRs) operating with software upgrades to provide the necessary track information as an emergency response system. The Tiger Team believed this approach offered the primary advantage of shortening development and deployment timelines. It also offered low cost and minimal development risk.

In the aftermath of the Tiger Team's efforts, the new Congress focused on achieving a 2003 deployment date for a National Missile Defense, although the language did not survive the conference function in either the authorization or appropriations processes for FY96. Secretary of Defense Perry conducted a BMD Program Review, which resulted in direction to BMDO to proceed with its current NMD effort, called "3 plus 3." The 3 plus 3 concept is designed to develop national missile defense systems that could be deployed within three years after a deployment decision is made. BMDO has stressed that within its 3 plus 3 concept, earlier deployment options will be protected. The Minuteman NMD is such an earlier deployment option which fits well within 3 plus 3, and is the least risky and least costly option for National Missile Defense. If required by the nation, Minuteman NMD can be operational by the end of the century.

## **Alternate NMD Approaches**

As part of the BMD Program Review, various NMD alternatives were developed and discussed. In addition to the baseline concept presented by BMDO, the Services developed alternatives for an NMD system. These alternatives are shown in Table 1. The alternatives included: (1) an Army program consisting of a new booster stack comprised of modified stages from existing rocket systems mated with an Exoatmospheric

Kill Vehicle (EKV), which is still under development; (2) a Navy Lightweight Exoatmospheric Projectile (LEAP)/Upper Tier system to be deployed on Navy AEGIS cruisers; and (3) an Air Force approach using Minuteman missiles retrofitted with a kinetic kill vehicle (KKV) configured to counter a rogue nation ballistic missile capability.

The Army's proposed system calls for concurrent development of a new booster, new kill vehicle, new Ground Based Radar (GBR) and new battle management command, control and communications (BM/C3) system, construction of new silos, and building some new base infrastructure.

The Navy's proposal, consisting of modified AEGIS cruisers, is not a candidate for near-term deployment for several reasons. First, it relies on the Space & Missile Tracking System (SMTS) whose first launch is not earlier than 2002 and, as an operational constellation, will not be available until 2003 at the earliest. Second, the ABM Treaty specifically prohibits sea-based ABM interceptors and launchers. Additionally, the Navy proposal costs approximately \$5-8B, not including kill vehicle, and would not be at sea until approximately 2004.

ALTERNATIVE NMD APPROACHES vs COST, TIMELINES, and ISSUES						
	Number of Launches/Interceptors	Cost (\$ in Billions)	Deployment of Initial 20 Systems	Major Program Issues	Arms Control Issues	Sensor Issues
AF Minuteman with KKV	20	\$2.4B (AF SPO figure)	4 years	None	Workable (CRG to decide)	None
Army "stacked" booster with an EKV	20	\$5B (USASDC figure)	5 years	Booster not selected/tested	Workable (CRG to decide)	Requires GBR (Still in engineering development) for system operation
Navy Upper Tier/LEAP on AEGIS Cruisers	300	\$5-8B excluding kill vehicle	2004 For first equipped AEGIS	Annual operating costs	ABM Treaty prohibits sea-based ABM (CRG to decide)	Relies on SMTS to be effective

**Table 1: Alternative NMD Approaches**

As shown in Table 1, the Minuteman NMD option, equipped with either an improved version of the existing LEAP kill vehicle projected for the KKV, and deployed in existing Minuteman silos, is an affordable, low-risk option that can, if required, be operational by the end of the century, makes maximum use of reliable and already proven systems, and could be fielded in compliance with existing arms control agreements--including the START and ABM Treaties. In addition, it will preserve scarce funding for developing longer-term NMD options.

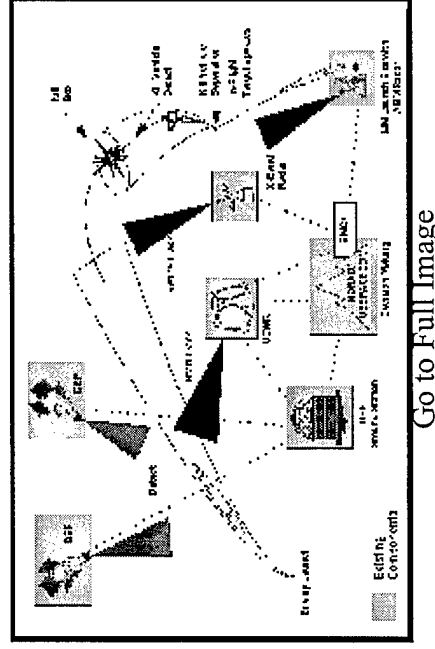
The near-term availability inherent in the Minuteman approach ensures coverage to hedge against possible delays in bringing future national missile defense technologies on-line. The present Minuteman infrastructure provides the option to field up to 100 or more interceptors at existing Minuteman missile bases.

#### **Minuteman NMD System Architecture**

The Minuteman-based interceptor architecture (see Figure 1) maximizes the use of several systems now in the field--the Minuteman booster and its infrastructure, strategic sensors, and existing BM/C3 infrastructure. Defense Support Program (DSP) satellites would detect threat launches and provide initial threat characterization. The DSP data would be used to cue the upgraded early warning radars (UEWRs), which in turn generate track information which is sent to the BM/C3 node at the Cheyenne Mountain Complex in Colorado. Information will then be forwarded to the interceptor site for launch and guidance. In addition, ground-based X-band dish antenna radars serving as adjuncts would provide fine tracking and discrimination to assist in identifying reentry vehicles (RVs) from other objects.

After detection and early warning of a hostile launch, the Minuteman-based interceptor would launch, acquire its target, and guide itself into the path of the oncoming warhead to destroy the target using kinetic energy. An ABM radar based on existing technology will be integrated into the system architecture at the interceptor site to provide updated guidance instructions to the kill vehicle.

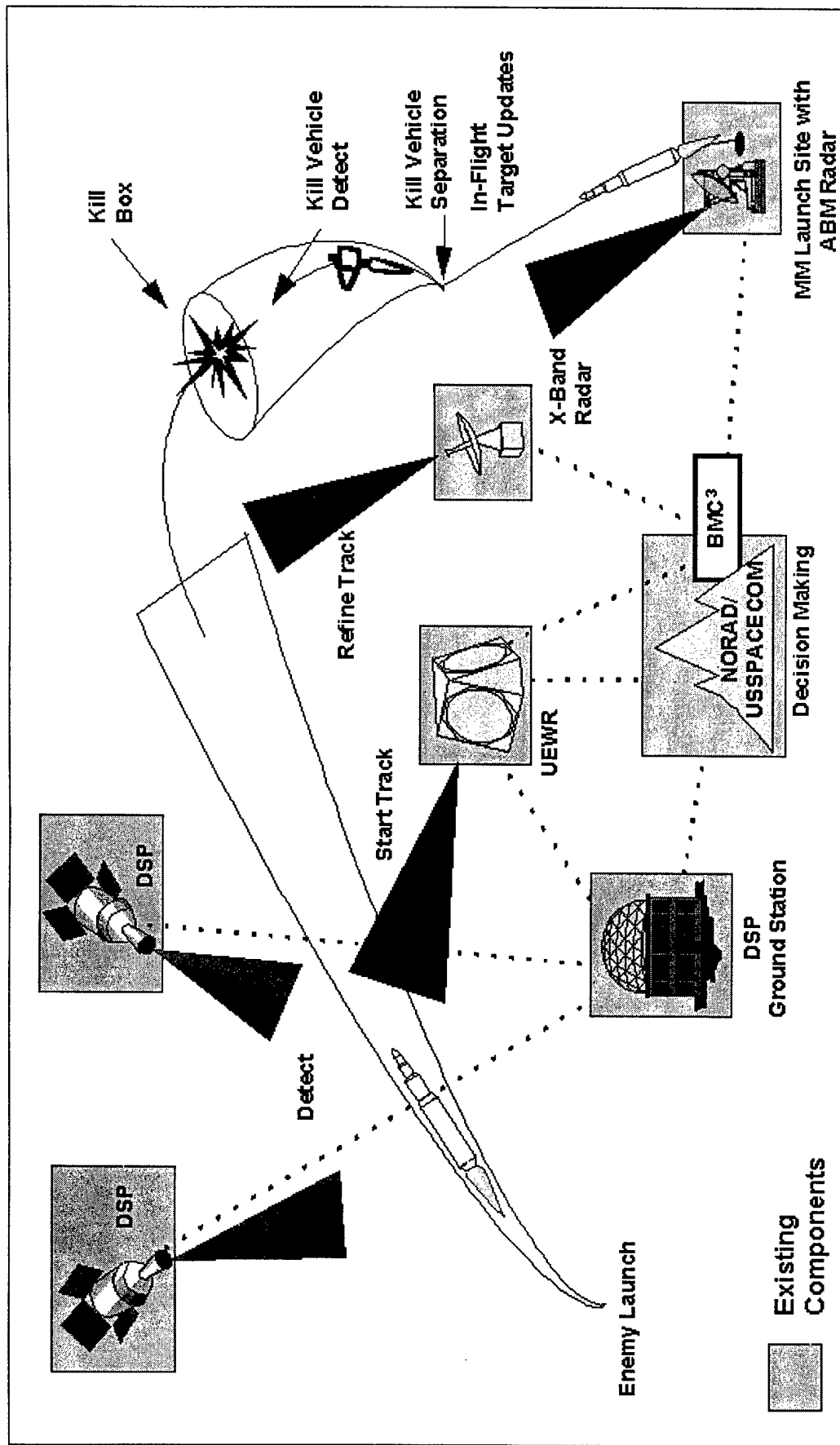
The interceptor would comprise all three stages of a Minuteman booster, structural frame of the bus, the missile guidance system, an advanced solid axial stage (ASAS--a solid propellant kick motor), a KKV, associated guidance and & control software, and auxiliary equipment. A key advantage of Minuteman is that it is compatible with a variety of NMD KKV's. This advantage stems from the fact that the Minuteman booster already has its own guidance system. This capability contrasts with competing designs which use "dumb" boosters that rely on guidance from the kill vehicle.



**Figure 1: Air Force NMD System Architecture**

### Current Minuteman System

The Minuteman has proven for over 30 years that it is one of the most reliable and effective systems in the U.S. weapon system inventory. During the long Cold War era, and continuing today, Minuteman has demonstrated its reliability through operational missile test flights at the Vandenberg test range and through regular functional electronic tests at each of the operational missile wings. The Minuteman booster is a tried and true system that has been maintained and modernized over the years. Minuteman solid booster motors are now being refurbished to extend their system life while retaining current reliability and performance, and all Minuteman III guidance sets are being upgraded with state of the art electrical components. The improvements are part of a program to maintain the Minuteman as a reliable and robust booster and guarantees



the continued integrity of the land component of our strategic offensive forces. As a result, Minuteman boosters used for NMD would provide the same level of surety as that of our ICBM force.

No significant change to the Minuteman infrastructure ground support systems would be required in order to convert Minuteman boosters to the defensive role. The Minuteman system already has a fully supported training and testing infrastructure with instructors, simulators, test launchers, and a fully operational test range.

The ICBM System Program Office has assessed the engineering plans necessary to convert Minuteman into a defensive role. After months of study, no technology "show stoppers" were identified. In fact, they found that converting the Minuteman to the proposed defensive role is a straightforward task of changing computer software and adding a kinetic kill vehicle and associated kick stage in place of the current re-entry vehicles. The Minuteman-based interceptor program would require at most four years to engineer, test, produce and deploy. The pacing item is the availability of a kill vehicle.

### **Arms Control Issues**

While there are arms control issues associated with any NMD proposal, the Air Force believes it has developed a treaty-compliant path to providing a near-term ballistic missile capability for the Nation. As with all options for NMD, the Minuteman NMD proposal will eventually require a fully coordinated analysis and decision as to its arms control compliance within DoD's Compliance Review Group (CRG) and possibly the Interagency arms control compliance communities. However, the Air Force believes the START and ABM Treaties present no insurmountable obstacles to the Minuteman NMD option.

The START Treaty does not specifically bar the employment of existing ICBMs as ABM interceptors. The Minuteman option does not remove Minuteman from START accountability. In fact, in order to enhance stability and build confidence between the U.S. and Russia, it would be preferable to retain accountability for all Minuteman. The bottom line on START is that as long as the Nation is willing to count defensive missiles against the offensive ceilings established by the Treaty, a Minuteman-based NMD does not violate START.

To avoid exceeding the ABM Treaty's numerical limits, it is essential to avoid contaminating deployed Minuteman ICBMs as ABM interceptors. The START Treaty provides a straightforward way to avoid contamination by using the Treaty's "new type" provisions. In order to preclude counting all Minuteman III ICBMs and launchers as ABM interceptors and launchers under the ABM Treaty, the United States could exercise the new type provisions of START. These provisions define several methods of creating a new type of missile used exclusively for ABM purposes. The most relevant method is the inclusion of an additional stage which imparts a minimum of 1 kilometer/second (km/s) additional velocity to the payload. Adding the ASAS "kick stage" associated with the KKV imparts sufficient velocity to meet the START Treaty's requirements for a new type of ICBM. As such, a Minuteman-based interceptor--configured as proposed--would fulfill the requirements for a new type of ICBM and the deployed Minuteman III ICBM force would not be contaminated.

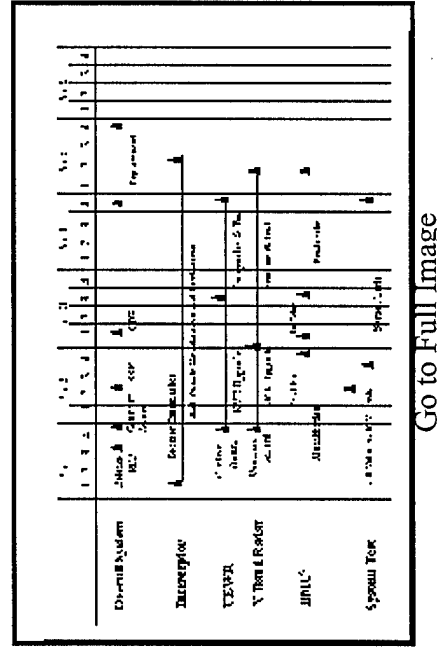
Article 6(a) of the ABM Treaty forbids giving ABM capability to non-ABM missiles, launchers, and radars. However, by using START's "new type" provision, ABM interceptors will be created by design for ABM use. These new ABM missiles will not be non-ABM missiles--they will be expressly ABM missiles. As a result, no violation of Article 6(a) would occur. More fundamentally, the purpose behind this provision was to preclude a particular cheating scenario--exceeding numerical limits on ABM interceptors with upgraded surface-to-air missile systems that did not count against ABM Treaty limits. As long as the United States would be willing to have the Minuteman-based interceptors accountable under the ABM Treaty and make them distinguishable, there would be no cheating potential. Moreover, the START Treaties provide the Russians inspection, notification, and data exchange rights that provide more information about the U.S. NMD system than would be obtained

if the U.S. built a brand new, dedicated defensive interceptor. In essence, the Minuteman NMD option would provide built-in confidence building measures.

From an arms control standpoint, the use of Minuteman would offer benefits over other approaches. As a result of the ABM interceptors including START-accountable first stages, the interceptors would be subject to both the ABM and START Treaties. This overlap would serve to enhance stability and confidence. In particular, the ABM interceptors would be subject to START's verification provisions (inspections, notifications, data exchanges, etc.), thereby increasing Russia's confidence in U.S. compliance on defenses well beyond that which could be achieved using the ABM Treaty's verification measures alone. By using START-accountable items to create and deploy ABM interceptors, the strategic offensive force must be reduced correspondingly to stay within START's numerical limits. This is a benefit since the U.S. could send no more powerful message about its peaceful intentions than by deploying defenses at the expense of the offense.

### Proposed Acquisition Concept

The Air Force Space and Missile Systems Center, the ICBM System Program Office, and the Electronic Systems Center are responsible for evaluating and costing the various operational elements of the Air Force Minuteman NMD option. They have been responsible for the deployment of advanced satellite constellations, strategic offensive missile systems, and C3 networks. Today, these systems are the backbone of our strategic deterrent force. Based on over 30 thirty years of experience in operations, procurement and hardware upgrades, there is every reason to believe that the estimate of 4 years to operational capability for under \$2.5 billion is conservative. Figure 2 summarizes the steps leading to rapid deployment after the program is approved. In addition, Minuteman, its associated infrastructure, and supporting C3 network, are ready elements which can support the recently adopted "deployment readiness" posture.



**Figure 2: Air Force NMD Acquisition Schedule**

Given the current budget constraints, the Air Force offers an NMD approach which maximizes the use of existing infrastructure and relies upon minimal modifications or upgrades to current systems. The Minuteman weapon system, DSP satellites, early warning radars, and their communications interfaces with USSPACECOM and the National Command Authority are all functioning weapons systems and command structures which have been incorporated into the Air Force NMD concept.





The Minuteman-based NMD approach would be consistent with DoD directives for major defense acquisition programs. These directives establish a hierarchy of five alternatives which must be considered prior to a decision to commit to a new-start acquisition program. The hierarchy calls for first seeking solutions which would use or modify an existing U.S. military system and, only as a last alternative, seeking solutions which would require a new Service-unique development program.

The Minuteman infrastructure-based approach is flexible. Limited numbers of ground-based interceptors at a single site would offer near-term defense against small, relatively unsophisticated threats - the threat that some foresee today from rogue nations - but also would allow growth in the future. A Minuteman-based system could expand with more interceptors or be improved through kill vehicle block upgrades if the threat evolves before future NMD options become available. As a result, it can contribute to a longer-term plan for providing an effective, robust ballistic missile defense of the U.S. The Minuteman NMD architecture would not preclude any long-term option, nor would it drive the long-term solution in any particular direction. It would simply put an effective homeland defense capability "on line" at the earliest possible time and for the least possible cost. This contrasts with NMD proposals that would build costly new infrastructures with long lead times and involve environmentally sensitive issues such as digging new missile silos -- taking even more resources away from the development of improved kill vehicles and future technologies.

### **Summary**

The U.S. has funded research and development of BMD since 1946. With the creation of the Strategic Defense Initiative in 1983, defense of North America against ballistic missile attack once again became a major national priority. With concern shifting away from the Cold War threat to the risk of ballistic missile attack from rogue nations, the objectives of today's BMD program have become more modest.

In response, the Air Force has developed an option which takes maximum advantage of established, operational capabilities to create a near-term, low-cost, flexible and stability-enhancing NMD system. In an era of declining resources, it is incumbent upon decision-makers to select the "best value" for every dollar expended on U.S. defense. The Minuteman option capitalizes on existing technology, proven reliability, and 35 years of operational experience to provide a near-term NMD capability.